

QUARTERLY REPORT – PUBLIC PAGE

Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage

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Technical Status

Software and Algorithm Development:

An algorithm that applies the scaling factor (as provided by PRCI and created by Battelle) to the high field data and creates a decoupled signal by combining the high and low field results has been implemented into standard Rosen software.

A decoupled signal search using the search algorithm provided by PRCI and created by Battelle can be done using a Matlab GUI for which further improvements are possible depending on the decoupled signal quality. A direct and independent search on the decoupled signal is challenging – evaluating the dual field data requires expertise and a comprehensive view of all data recorded (high and low field data, along with caliper arm data). Additionally, a complete priority ranking depends on data quality and the signal to noise ratio.

The Matlab GUI searches a data matrix, allowing value extraction from the decoupled signal which is used to support the priority classification algorithm. The data extraction is used to determine the following parameters: feature type, gouge length, peak amplitudes, dent depth based on halo information and the severity index. These parameters serve the priority classification algorithm provided by PRCI and created by Battelle. The priority classification algorithm can be viewed as a decision tree which is used to arrive at a priority classification using inputs derived from the decoupled signal.

Pipeline 1 Dual field Inspection

A field inspection was completed using the dual field tool in May 2008. The inspection was performed on a 30-inch diameter operating liquid pipeline in North America along an approximately 200-mile segment. The processing and evaluation of dual field inspection data is underway, with data analysis approximately 75% complete, and when completed will provide the basis for developing the proposal for field verification digs and inspection (Task A-4.1). Preliminary analysis of the data has shown that high and low field levels were out of the specified ranges for approximately the second half of the run, therefore verification excavations should only be conducted on approximately the first half of the inspection.

Results and Conclusions

ROSEN's standard evaluation environment is shown in Figure 1, and a similar environment will be used to evaluate the data from the line 1 inspection.

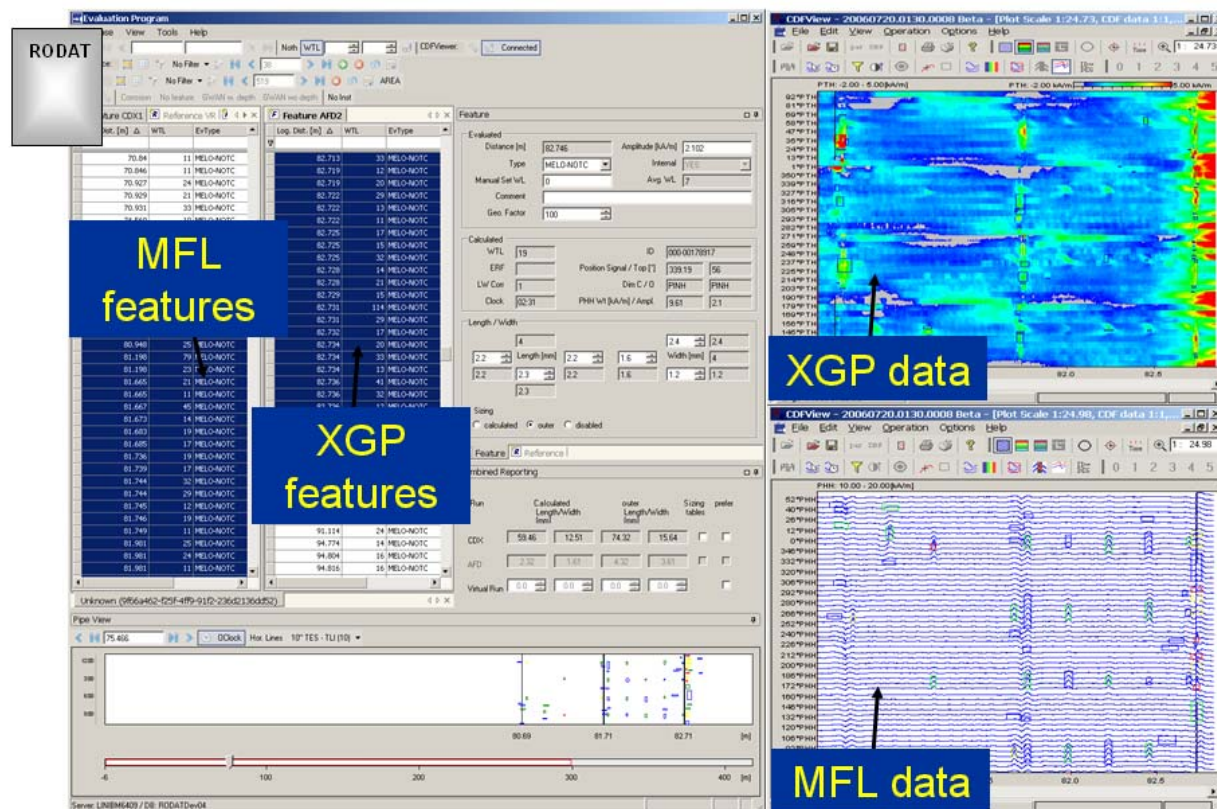


Figure 1: Example of a standard ROSEN evaluation environment, displaying caliper arm (XGP data), MFL data, and lists of MFL and XGP features that are created based on this data. Note this is not a display of the data from the Pipeline 1 inspection, but the Pipeline 1 inspection will be evaluated in a similar environment

Sample, preliminary data from the Pipeline 1 inspection is shown in Figure 2.

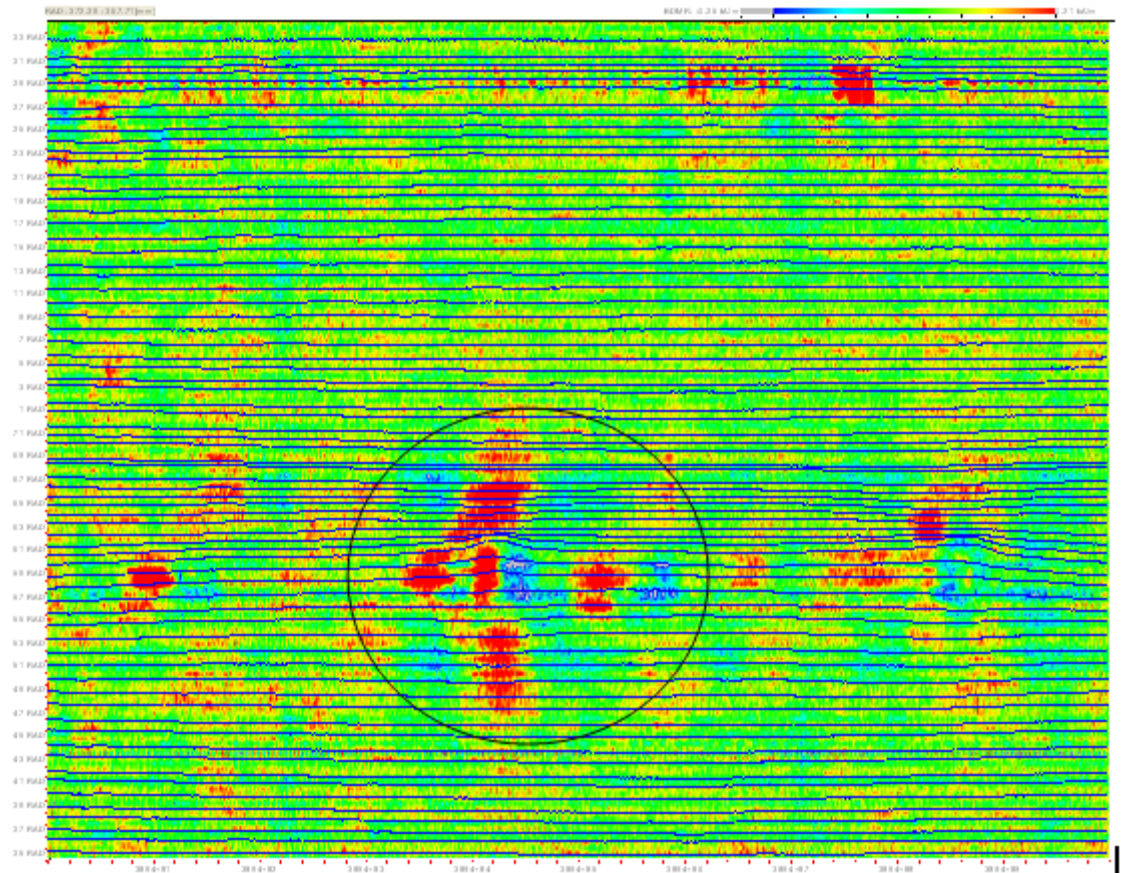


Figure 2: Example of decoupled MFL dual field data (color plot) from Pipeline 1 inspection with caliper arm data (line plot overlaid on decoupled MFL dual field data). The decoupled MFL background has been subtracted and red values indicate a decoupled signal magnitude that is positive with respect to the background, while blue values indicate a decoupled signal magnitude that is negative with respect to the background. Any changes from the horizontal in the line plots indicate an internal diameter anomaly as detected by the caliper arm tool. The circled area indicates an internal diameter anomaly as indicated by both the line plot and the color scan. This data is a preliminary example for this report only and factors such as background subtraction, signal gain, offset, and scaling factors may be modified.

Issues, Problems or Challenges

High and low field levels were not within specifications over entire segment of the pipeline inspected. Because of this, verification digs and field data collection to characterize the defects will likely only be done on the portion of the pipeline line within which specified field levels were achieved, which is approximately the first half of the line inspected.

The decoupled dual field data search was developed by Battelle based on its own specific prototype tool, pull tests, and line conditions. Decoupled signal patterns that differ from Battelle's experience or low quality (noisy) data from the pipeline line 1 inspection will affect the search. Battelle has been asked to review the decoupled data and suggest any decoupled search modifications that are seen as necessary.

There are several issues and challenges regarding project scheduling that are currently being addressed in coordination with PHMSA. PRCI submitted a letter dated July 30 that requested a 60-day extension to the project contract/OTA. The extension was requested to provide the time needed to complete a contract modification to incorporate additional federal funds obligated to the project by DOT. PRCI will also prepare a separate (and subsequent) modification to the current project and milestone deliverable schedule. The initial project schedule was estimated at 24 months. Recent analysis by our research team indicates that a more representative estimated period to complete the comprehensive set of project milestones is up to 60 months. The extended time required to complete the project milestones is due to a number of factors:

- There was a 6-month delay in starting the project, defined as the date of the kick-off meeting.
- Pipe samples with representative mechanical damage defects were not available from the participating operating companies. This resulted in the need to buy pipe and have defects created.
- The schedule for the field activities for Pipelines 1 and 2 requires substantial planning and coordination with the representatives of the operating pipeline companies, and has shown to be much more extensive than initially projected.

Plans for Future Activity

A meeting among the core technical team representatives (Battelle and Rosen) is scheduled at Rosen's Houston office on August 4th and 5th.